

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group I, claims 1-18, in the reply filed on February 12, 2010 is acknowledged. The traversal is on the ground that claims 19 and 21, as amended, are each dependent on claim 1, and therefore, the claims should not be restricted since claims 19 and 21 include the same technical features as claim 1. This argument, however, is not persuasive.

As amended, unity exists between claims 1, 19 and 21. The technical feature common to the claims is an apparatus comprising a chamber having a plurality of externally mounted and longitudinally spaced transducers coupled thereto. However, the group of inventions do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical feature. It is noted that the technical feature of an apparatus comprising a chamber having a plurality of externally mounted and longitudinally spaced transducers was known in the art, as evidenced by Vuhnovic et al. (cited in the International Search Report) and the prior art cited below. Thus, there is no special technical feature common to claims 1, 19 and 21 because the technical feature is not a special technical feature, i.e., it does not make a contribution over the prior art.

The requirement is still deemed proper and is therefore made FINAL.

2. Claim 19-21 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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3. Claims 6 and 9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 6, it is unclear as to what physical "distance" is being claimed between the spaced apart transducers, since the wavelength of the excitation frequency of the transducers will vary depending on the intended use of the apparatus. The reference to an object that is variable renders the claimed distance indefinite. See MPEP §2173.05(b).

Regarding claim 9, it is unclear as to the *structural* limitation applicant is attempting to recite by the limitation of "the reaction chamber is oil-cooled".

Claim Rejections - 35 USC § 102 and § 103

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c)

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and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1, 2, 7, 8, 10, 15 and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Benson (US 2,578,505).

Regarding claims 1, 7, 8 and 15, Benson (FIGs. 1, 2; column 1, line 56 to column 3, line 16) discloses an apparatus that is capable of functioning as a reactor, said apparatus comprising: a chamber (i.e., defined by a thin-walled right circular cylinder or pipe **10**) having a separate inlet and outlet and a plurality of externally mounted transducers **11**, **11'** physically coupled thereto; the transducers **11** and **11'** being spaced apart along a longitudinal axis of the chamber (i.e., as separate bands); each transducer **11** and **11'** lying substantially within a respective plane orthogonal to the longitudinal axis; and said transducers being capable of being operated to excite the chamber walls in a breathing mode. If the prior art structure is capable of performing the intended use, then it meets the claim.

Regarding claim 2, cavitation may be induced predominantly in a central region remote from the chamber wall (i.e., about the central axis **O**; see FIG. 1; column 2, lines 32-45).

Regarding claim 10, the recitation with respect to the intended manner of operating the apparatus (i.e., the manner of driving the transducers in phase) does not impart further patentability to the claim. See MPEP §2114.

Regarding claim 16, Benson further discloses a controller (i.e., an oscillator; FIG. 1) that would be capable of operating the transducers **11**, **11'** in a breathing mode.

5. Claims 1-3, 6-10 and 15 are rejected under 35 U.S.C. 102(b) as being anticipated by Massa (US 3,464,672).

Regarding claims 1, 3, 7, 8 and 15, Massa (see FIGs. 3, 4; column 4, lines 5-53) discloses

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an apparatus that is capable of functioning as a reactor, said apparatus comprising a chamber (i.e., defined by a thin walled right circular cylinder or tube **90**) having a separate inlet and outlet and a plurality of externally mounted ring transducers coupled thereto (i.e., ceramic rings **12**); the transducers being spaced apart along a longitudinal axis of the chamber; each transducer **12** lying substantially within a respective plane orthogonal to the longitudinal axis, and the transducers being operable to excite the chamber wall in a breathing mode. If the prior art structure is capable of performing the intended use, then it meets the claim.

Regarding claim 2, the apparatus would be capable of inducing cavitation within the chamber predominantly in a central region remote from the chamber wall, by the selection of an appropriate wavelength to be generated by the transducer. (see also column 5, lines 3-7).

Regarding claim 6, as best understood, the spacing of the transducers in the apparatus of Massa meets the claim for a predetermined excitation frequency.

Regarding claim 9, the apparatus comprises a means for cooling the chamber (i.e., an outer tube **92** defines an annular space for air or another fluid for cooling the transducer **12**; FIGs. 3, 4; column 4, lines 35-44). The specific fluid, however, has not been considered an element of the apparatus. See MPEP §2115.

Regarding claim 10, the recitation with respect to the intended manner of operating the apparatus (i.e., the manner of driving the transducers in phase) does not impart further patentability to the claim. See MPEP §2114.

6. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Massa (US 3,464,672) in view of Fanning et al. (US 4,855,964).

Massa discloses that the ring transducers are poled (i.e., electrodes **14** and **16**; FIGs. 3, 4).

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With respect to the transducers being radially or tangentially poled, Fanning et al. similarly teaches a ring transducer (i.e., cylinder **22**; FIG. 3), wherein the transducer may be radially poled (see column 2, lines 38-51), or tangentially poled in the event that more output power was desired (see column 3, lines 32-43). Accordingly, it would have been an obvious design choice for one of ordinary skill in the art at the time the invention was made to configure the transducers in the apparatus of Massa to be radially poled or tangentially poled, depending on the output power desired for the intended use, as taught by Fanning et al. (see column 3, line 32-43).

7. Claims 1-3, 6-10, 15 and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Marhasin (WO 03/101609).

Regarding claims 1, 3, 7 and 8, Marhasin (see FIGs. 1-3; page 16, last paragraph; page 18, last paragraph) discloses a sonochemical reactor **30** comprising a reaction chamber **19** defined by a thin-walled right circular cylinder **9** and having a plurality of externally mounted ring transducers (i.e., elements **28a**, **28b**, **28c** and **28d**) physically coupled thereto; the transducers being spaced apart along a longitudinal axis of the chamber; each transducer lying substantially with a respective plane orthogonal to the longitudinal axis; and said transducers being capable of being operated to excite the reaction chamber wall **9** in a breathing mode. If the prior art structure is capable of performing the intended use, then it meets the claim.

Regarding claim 2, the apparatus may be operated in a manner to induce cavitation within the reaction chamber predominantly in a central region (i.e., as a cavitation stream **37** along longitudinal axis **32**) remote from the reaction chamber wall **33** (see FIG. 3; page 19, first paragraph; page 23, first and second paragraphs).

Regarding claim 6, as best understood, the spacing of the transducers in the apparatus of

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Marhasin meets the claim for a predetermined excitation frequency.

Regarding claim 9, the reaction chamber **19** comprises means (i.e., a cooling chamber **26**; FIG. 1; page 16, last paragraph) for cooling the reaction chamber. The apparatus would be structurally capable of enabling the reaction chamber to be oil cooled, since oil could be circulated through the cooling chamber **26** via the cooling liquid inlet pipe **3** and the cooling liquid outlet pipe **4**. The specific cooling liquid has not been considered an element of the apparatus. See MPEP §2115.

Regarding claim 10, the recitation with respect to the intended manner of operating the apparatus (i.e., the manner of driving the transducers in phase) does not impart further patentability to the claim. See MPEP §2114.

Regarding claim 15, a separate inlet (i.e., feed tube **20**) and outlet (i.e., secondary tube **22**) are provided to the reaction chamber **19** (see FIG. 1 and page 18, second paragraph).

Regarding claim 16, a controller (i.e., inherently provided with the generator **45**; FIG. 2; page 22, last paragraph) is capable of operating the transducers in a breathing mode.

8. Claims 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Marhasin (WO 03/101609) in view of Haggett et al. (US 2002/0164274).

Regarding claim 17, although Marhasin does not specifically disclose a holding tank connected to the inlet **20** and a collection tank connected to the outlet **22**, it would have been obvious for one of ordinary skill in the art at the time the invention was made to provide such tanks in the apparatus of Marhasin, because the provision of tanks for storing the materials to be fed to or discharged from an apparatus would have been considered conventional to those having ordinary skill in the art, as evidenced by Haggett et al. (see FIG. 3; paragraph [0046]).

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Regarding claim 18, Marhasin fails to disclose a plurality of said reactors, wherein a manifold connects the holding tank to the plurality of reactors. Haggett et al., however, teaches an apparatus comprising a plurality of chambers (i.e., a plurality of modules **40**; see FIGs. 4, 5; paragraphs [0049]-[0050]) each provided with an inlet and an outlet; wherein a manifold (i.e., input manifold **50**) connects the holding tank to the plurality of chambers. It would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the apparatus of Marhasin as claimed, because the provision of plurality of reactors would have allowed for an increase in capacity of the system, and the manifold would have allowed for the plurality of chambers to be connected to a single material supply with a minimal number of connections, as suggested by Haggett et al.

9. Claims 1, 2, 6-10, 15 and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Perkins (WO 00/35579).

Regarding claims 1, 7 and 8, Perkins (see FIG. 1 or FIGs. 2-3; page 5, line 1 to page 7, line 35) discloses an apparatus that is capable of functioning as a reactor, said apparatus comprising: a chamber defined by a thin-walled right circular cylinder (see figures; also, page 5, lines 1-3; page 6, lines 10-21) and having a plurality of externally mounted transducers (i.e., modules **14**, including transducers **16** and coupling block **18**) physically coupled thereto; the transducers being spaced apart along a longitudinal axis of the chamber (i.e., as separate bands); each transducer lying substantially within a respective plane orthogonal to the longitudinal axis; and said transducers being capable of being operated to excite the chamber walls in a breathing mode. If the prior art structure is capable of performing the intended use, then it meets the claim.

Regarding claim 2, the apparatus of Perkins would be capable of inducing cavitation

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within the chamber predominantly in a central region remote from the chamber wall via the selection of an appropriate wavelength generated by the transducers, due to the arrangement of transducers about the circumference of the chamber wall (see FIG. 3).

Regarding claim 6, as best understood, the spacing of the transducers meets the claim for a predetermined excitation frequency (see page 6, lines 21-26; page 7, lines 29-33).

Regarding claim 9, the chamber may be oil cooled (i.e., oil **40** may be used as the buffer liquid in gap **36**; see FIGs. 2-3; page 6, lines 27-30)

Regarding claim 10, the recitation with respect to the intended manner of operating the apparatus (i.e., the manner of driving the transducers in phase) does not impart further patentability to the claim. See MPEP §2114.

Regarding claim 15, Perkins discloses a separate inlet and outlet (i.e., located at flanges **33**; FIG. 2) provided to the chamber.

Regarding claim 16, Perkins further discloses a controller (i.e., a signal generator **20**; FIG. 1; see page 5, first paragraph) capable of operating the transducers in a breathing mode.

10. Claims 3-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Perkins (WO 00/35579) in view of Fanning et al. (US 4,855,964).

Perkins fails to disclose a ring transducer, or that the transducer is a radially poled transducer or a tangentially poled transducer. Fanning et al., however, teaches the use of a ring transducer (i.e., cylinder **22**; FIG. 3) wherein the transducer may be radially poled (see column 2, lines 38-51). Alternatively, the transducer may be tangentially poled, in the event that more output power was desired (see column 3, lines 32-43). It would have been obvious for one of ordinary skill in the art at the time the invention was made to substitute the ring transducer of

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Fanning et al. for the transducers in the apparatus of Perkins, because the substitute of one transducer for another known transducer, for providing the same result of radially irradiating fluids, involves only ordinary skill in the art, *In re Fout* 213 USPQ 532 (CCPA 1982); *In re Susi* 169 USPQ 423 (CCPA 1971); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); *In re Ruff* 118 USPQ 343 (CCPA 1958), and when the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result, *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (2007). Furthermore, it would have been an obvious design choice for one of ordinary skill in the art at the time the invention was made to select a radially poled transducer or a tangentially poled transducer, depending the output power desired for the intended use, as taught by Fanning et al. (see column 3, line 32-43).

11. Claims 3 and 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Perkins (WO 00/35579) in view of Haggett et al. (US 2002/0164274).

Regarding claim 3, Perkins is silent as to the transducers comprising ring transducers. Haggett et al., however, teaches the use of ring transducers (i.e., rings 1; FIGs. 1, 2; paragraph [0033]-[0034]). It would have been obvious for one of ordinary skill in the art at the time the invention was made to substitute the ring transducers of Haggett et al. for the transducers in the apparatus of Perkins, because the ring transducers would have provided a fairly even radial distribution of energy in a fluid (see paragraph [0032]). Furthermore, the substitution of known equivalent structures involves only ordinary skill in the art. *In re Fout* 213 USPQ 532 (CCPA 1982); *In re Susi* 169 USPQ 423 (CCPA 1971); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); *In re Ruff* 118 USPQ 343 (CCPA 1958), and when the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than

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yield a predictable result, *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (2007).

Regarding claims 17 and 18, Perkins does not specifically disclose a holding tank connected to the inlet of the chamber and a collection tank connected to the outlet of the chamber, or a manifold connecting the holding tank to a plurality of the chambers. Haggett et al., however, teaches an apparatus comprising a chamber (i.e., module **40**; see FIG. 2) provided with an inlet and an outlet, wherein the inlet is connected to a holding tank (i.e., a tank **30**; FIG. 3) and the outlet is connected to collection tank (i.e., a tank **32**; FIG. 3). Furthermore, the apparatus may comprise a plurality of chambers (i.e., a plurality of modules **40**; see FIGs. 4, 5; paragraphs [0049]-[0050]) each provided with an inlet and an outlet; wherein a manifold (i.e., input manifold **50**) connects the holding tank to the plurality of chambers. It would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the apparatus of Perkins as claimed, because the provision of plurality of chambers would have allowed for an increase in capacity of the system, and the holding tank, collection tank and manifold configuration would have allowed for the plurality of chambers to be connected to a single material supply with a minimal number of connections, as suggested by Haggett et al.

12. Claims 11-14 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Perkins (WO 00/35579).

Perkins (see FIGs. 2-3; page 6, lines 17-30) discloses a sleeve (i.e., tube **35**) disposed around the chamber, the transducers **14,16,18** being mounted on an outer face of the sleeve **35** and the volume (i.e., gap **36**) between the sleeve and the chamber containing a first fluid (i.e., oil **40**), wherein the first fluid **40** is circulated (i.e., to and from a reservoir **42** by a pump **44**; FIG. 2). A second fluid would be inherently located around the transducers and within the acoustic

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shield **38**. The specific fluids are not considered elements of the apparatus. See MPEP §2115. In any event, the examiner takes official notice that the selection of air for the second fluid would have been obvious to those having ordinary skill in the art. The viscosity of the first fluid (i.e., oil) would therefore be higher than the viscosity of the second fluid (i.e., air).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JENNIFER A. LEUNG whose telephone number is (571) 272-1449. The examiner can normally be reached on 9:30 am - 5:30 pm Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Walter D. Griffin can be reached on (571) 272-1447. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jennifer A. Leung/
Primary Examiner, Art Unit 1797